BEFORE THE STATE OF WASHINGTON
ENERGY FACILITY SITE EVALUATION COUNCIL

In re Application No. 96-1	)
of	)
OLYMPIC PIPELINE COMPANY	)
For Site Certification	)

PRE-FILED TESTIMONY OF DAVID F. DICKINS

ISSUE:

SAFETY AND RISK

SPONSORS:

Tidewater Barge Lines
Tidewater Terminal Company
Maritime Environmental Coalition

Q. Please introduce yourself to the Council.

A. My name is David F. Dickins. I reside and work at 246 Gravilla Street, La Jolla, California 92037.

Q. Please describe your professional qualifications and experience pertaining to your testimony.

A. I hold a Bachelors Degree in Mechanical Engineering (BAsc) from the University of British Columbia (1971) and am a member of the Society of Naval Architects and Marine Engineers. My work experience includes 28 years in environmental studies, marine transportation and oil spill research in Canada and the United States. I formed my own company in 1978 (incorporated 1981 in the Province of British Columbia) under the name DF Dickins Associates Ltd., with the purpose of carrying out engineering research studies for marine transportation and development projects.

I have managed and participated in over 100 studies and programs dealing with issues such as the environmental sensitivity of shorelines to oil spills, tanker double hulls, spill response atlases, oil waste disposal strategies, shipyard environmental practices, tanker barge safety, and marine pipeline spills. I have also participated in approximately 25 risk assessments, and a variety of consulting assignments, including safety and risk consulting for the States/British Columbia Task Force on Oil Spills. A more detailed summary of my experience is attached as Exhibit DFD-1.

Q. Which mode of petroleum transportation is safer: the current marine transportation system, or the proposed Cross Cascade pipeline?

A. The current marine transportation system is much safer than the proposed pipeline.

Q. Why?

A. Over the first 50 years of operation, the pipeline is expected to leak 990,431 gallons of petroleum into the environment (<u>not counting</u> spills under 2,100 gallons). Over the same period of time, the Columbia River marine transport system is expected to lose 49,600 gallons to the environment (<u>counting every</u> spill over 21 gallons).

Q. What did you review with respect to the Cross Cascade Pipeline Proposal?

A. I reviewed Tidewater's operating and management practices with respect to spill prevention and environmental awareness, the historical spill record on the Columbia/Snake River system, the characteristics and design features of the new double hull barges introduced by Tidewater beginning in 1994, Olympic's spill history with the existing north/south pipeline system, national trends in pipeline and marine vessel spill rates and volumes from the 1970s to the 1990s, and current sources of spill statistics for barges in U.S. domestic trade.

Q. What topics will you address in this direct testimony?

A. My testimony will generally address the safety issues and risk analysis necessary to compare marine transport of petroleum with pipeline transportation. My testimony is broken down into three topics:

First, I address safety issues and the overall spill risks for barges and pipelines, including an analysis of how those spill risks change over time.

Second, I address the fact that the projected spill risks contained in the Revised Application (Application) are wrong.

Finally, I address the fact that the proposed pipeline creates a dramatically greater risk of spills to the environment than the current petroleum transportation system.

Q. What sources did you use in order to determine the present and future risk of the "No Action Alternative," principally the existing marine transport system on the Columbia River?

A. The sources I used in analyzing the present and future risk of the existing marine transport system are set forth in Exhibit DFD-2. These sources represent a comprehensive compilation of the documents necessary to provide the Council with an accurate presentation of the present and future risks of petroleum transportation.

Q. What sources do you rely upon for your statements concerning the risk of the proposed pipeline?

A. I relied upon the Risk Assessment Study for the Cross Cascade Pipeline completed by John Mastandrea, which is attached to his pre-filed testimony as Exhibit JRM-2. This Study is a comprehensive analysis of risks associated with pipelines.

Q. Please summarize your conclusions with respect to each of the topics contained in your testimony.

A. First, pipelines present a far greater risk of spills than the current marine transportation system. The comparative spill risks between the two systems change dramatically over time, with the spill risk from barges remaining relatively static, and pipeline spill risk increasing by an order of magnitude over a 45 year period. Further, marine transportation is governed by a much more rigorous set of safety regulations than pipelines. Unlike pipeline regulations, marine transportation regulations require a greater focus on protection of the environment and overall human and ecological safety.

Second, the projected spill risks contained in the Application for this project are wrong. The spill risk analysis contained in the Application ignores a vast amount of readily available information, neglects to predict spill frequency with a consistent threshold volume, and distorts the analysis by selectively ignoring certain beneficial aspects of the marine transportation system.

Finally, the proposed pipeline presents a far greater risk to the environment than the current marine transportation system now and in the future.

Q. Can you summarize the comparative spill risks between barges and the proposed pipeline.

A. Yes. At the beginning of the life of the pipeline, it is expected to have a spill frequency of 0.22 spills per year. Over fifty years, this will rise to 2.49 spills per year.

At present, barges have an expected spill frequency of 0.52 spills per year. Over fifty years, this is expected to rise to 1.00 spill per year.

Q. Can you summarize the comparative spill volumes between barges and the proposed pipeline.

A. Yes. At the beginning of the life of the proposed pipeline, it is expected to spill 13,512 gallons per year into the environment. Over fifty years, the total amount expected to be spilled by the proposed pipeline will be over 990,431 gallons.

At present, barges are predicted to spill 1,603 gallons per year on average. Over fifty years, the total amount expected to be spilled by barges is 49,632 gallons. These spill estimates are based on national barge spill rates. In practice, between 1986 and 1997

Tidewater's marine transportation operations released an average of only 360 gallons per year.

These comparisons are shown more fully in Exhibit DFD-3.

Q. How did you estimate barge spill risk for the present time and for the future?

A. Marine spill risk is considered in terms of the predicted frequency and predicted volume of a spill above a minimum specified size. My analysis began with two ranges of spill sizes deliberately chosen to allow direct comparison with the proposed pipeline: spills between 21 and 2100 gallons (referred to as leaks in the pipeline spill analysis), and spills over 2,100 gallons (referred to as ruptures in the pipeline spill analysis). My analysis then went through a series of steps designed to produce a value assignable as a "spill risk." This can also be called the spill frequency associated with a given spill size.

First, I used current spill sources to develop an accurate value for the number of barge spills per year over the five year period from 1992 to 1996. This number included petroleum barges in both coastal and internal (river and lake) trade. According to the Coast Guard's spill experts in Washington, D.C. (T. Gilbreath, C. Boegel), there is no accurate way to determine which incidents in the database occur in a river and which occur in a harbor or coastal environment without manually opening and reviewing each incident file on a national basis. Therefore, this part of my analysis is conservative as it includes ocean barge events which are more likely to be involved in incidents with a large loss of product.

Second, I calculated spill frequency as an expression of national spill numbers divided by tons of product moved on barges in U.S. domestic trade. This information was gathered from the U.S. Army Waterborne Commerce reports; the only known sources of reliable national statistics on the volume of petroleum products. I also made efforts to explore other options, such as introducing the number of trips or distance traveled, to more accurately depict spill frequency, but determined that none of the available data sources were sufficiently reliable or consistent enough to use in this analysis.

Third, I took the national spill rate I derived in steps one and two and modified it to reflect the National Research Council's 1998 engineering findings showing a significant reduction in the number of spills from double hull barges involved in groundings and collisions, and applied both rates (for single and double hulls) to the marine transport operations (1998) on the Columbia River. Results of this analysis predict the number of spills which could occur annually in the future on the Columbia/Snake River systems as a result of continued petroleum barge operation.

Fourth, I estimated the annual spill volume as the sum of the number of spills in each size range multiplied by the expected volume, again accounting for the reductions in volume spilled by double hull barges in certain types of incidents.

Q. What conclusions about spill frequency did you draw from this analysis?

A. Over time, pipelines will spill a great deal more petroleum into the environment than barges. Over the first five years following construction, a new pipeline is expected to have almost the same number of spills over 2,100 gallons as the existing barge system (approximately 0.45 per year). By the time the pipeline is between five and fifteen years old, the annual number of expected pipeline spills over 2,100 gallons will be 0.08 (one spill every 12.5 years), while the annual number of expected barge spills will remain 0.05 (one spill every 20 years). By the time the pipeline is 25 years old (2024) the number of pipeline spills over 2,100 gallons is expected to reach an average of 0.23 per year (one spill every 4.3 years) while the number of equivalent spills from the barge system at that time is predicted as 0.04 per year (one spill every 25 years). By 2045 the number of spills of any size from the pipeline (as small as 21 gallons) is predicted to be 2.48 per year while the equivalent annual rate of all spills from the barge system is predicted as 0.93 per year. Over that period of time, the pipeline experience on average nine times as many spills over 2,100 gallons as the barge system. This comparison is set out in Exhibit DFD-4.

In summary, the two transportation systems are approximately equal in terms of numbers of large spills for the first five years of the pipeline's life. After five years, the barge system is expected to become dramatically safer over time (effect of increasing double hull transport) while the pipeline becomes increasingly riskier (effect of aging of the buried line).

Q. What conclusions about spill volume did you draw from your analysis?

A. The pipeline consistently spills far more oil in each year of its life than the barge system. In the first five years following construction, the cumulative volume predicted to be spilled by the pipeline is 67,560 gallons. This is seven times greater than the volume predicted to be spilled by the barge system during the same time period. As the pipeline ages, and an increasing proportion of petroleum moved in the marine system is transported via double hulls (becoming 100% in 2015), the difference in volume spilled between the two systems becomes enormous. After 25 years the predicted volume spilled from the pipeline reaches 450,191 gallons, while the barge system is predicted to spill a total of 31,872 gallons over the same period, a difference of over 400,000 gallons. Fifty years after construction of the pipeline, the predicted difference in total volume spilled is almost a million gallons. See Exhibit DFD-3.

Q. Can you describe some of the relative safety and design features associated with double hull barging on the Columbia River system?

A. Yes. The double hull barges that Tidewater operates on the Columbia River provide significant safety features, some of which far exceed that required by law.

First, the term "double hull" means that the barge is essentially a "barge within a barge." It contains a large void or air space between the inner cargo hull and the outer hull. The Oil Pollution Act of 1990 (OPA 90) mandated that all barges constructed after 1995 be double hulled, and that all existing single hull barges under 5,000 gross tons be retired by the end of 2014. The barges that Tidewater operates have a full 36 inches between the outer hull and the side of the inner cargo tanks, and between 30 and 36 inches between the outer hull and the bottom of the cargo tank. The Coast Guard's OPA 90 regulations only require a 24 inch space on the bottom. This increase in dead hull space provides additional insurance against any ruptures of the cargo tanks during collisions or groundings. Schematics and drawings of a double hull barge are set out in Exhibit DFD-5, pgs. 1-8.[1]

Second, hull plating on Tidewater's barges is 1/2 inch steel throughout. This is 30% to 44% thicker than the plating thickness required by the American Bureau of Shipping (ABS) standards for new construction which have been adopted by the U.S. Coast Guard. Tidewater adopted the thicker plating to make the hulls stronger and further reduce the chances of a spill.

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[1] Although these drawings depict the layout of a double hull barge, they are geared more for an engineer. Simpler, illustrative materials may be used at the hearings to provide the Council a less complicated demonstration of the characteristics of double hull barges. Any such materials will be provided to all other parties far in advance of the hearing.

Third, the double hull barges have additional rub strakes at the bow and stern which provide additional protection from abrasions such as rubbing against lock walls.

Fourth, the double hull barges have viewing ports and multiple audio and visual alarms, including "pop up" sticks, which help prevent human operators from overfilling the cargo tanks.

Fifth, the double hull barges bear a “coaming,” or raised steel sill, around the entire upper trunk deck. This coaming is designed to contain any deck spills. Scuppers (deck drains) are plugged during barge loading operations to make the coaming act as a protective berm around the loading operations.

Sixth, the barges include a fully enclosed tankerman's shelter. This shelter allows the tankerman to manage all of the controls that govern off-loading the barge to a shore facility. The shelter provides a 360 degree view of the deck operations.

Seventh, the barges include a full suite of spill response equipment stored in a dedicated environmental container. The container includes 1,200 ft of boom, pumps, skimmers and other spill response gear which can be deployed immediately. A work skiff and motor are stored on deck, and can be immediately deployed to assist with setting up and maintaining an oil boom around the barge.

Finally, the barges have an “Ecology House” which provides a weatherproof shelter for the barges manifolds and valves, and a full containment sump to catch any leaks or spills at the connection between the barge manifold and the dock hose. All mechanical operating components on the barge are duplicated (including pumps, hydraulics, generators, hose cranes, etc.), in order to provide full redundancy and additional safety to the environment.

A color picture of one of Tidewater's barges is attached as Exhibit DFD-6. Most of the above described safety features and equipment are visible from this picture, except of course, the double hull.

Q. Those safety features are very impressive. What type of marine spill response occurs if petroleum is spilled into the water?

A. The response is comprehensive. I have detailed two spill scenarios in Exhibit DFD-7 and DFD-8. These spill scenarios are built using the basic physical setting depicted in Scenario #13 of the Cross Cascade Pipeline Product Spill Analysis. However, unlike that scenario, the two that I have detailed paint an accurate picture of how two hypothetical response actions would proceed. Further, the Application makes outrageous assumptions concerning the loss of product volume. These two scenarios illustrate an "expected worst case" scenario. In other words, while the Application suggests an almost impossible worst case scenario, I have provided a very credible worst case scenario.

While the attached spill scenarios portray response actions, a narrative description of the marine spill prevention and response planning efforts is also warranted in order to further explain the comprehensive approach to spill prevention.

Tidewater's Environmental Services group maintains and delivers a comprehensive response capability which is able to deal with spills up to a complete loss of its largest barge. Contingency plans are continually updated for each facility and the vessels in accord with federal and state requirements. In addition, geographic action plans identify sensitive areas along the entire system and specify strategies for protection, diversion and clean-up at particular locations. Tidewater has worked closely with state and federal agencies to develop detailed sensitivity maps of the entire river barge system.

Within its own organization, Tidewater maintains 10 response trailers spread along the entire barge route so as to be no more than 2 hours travel from any point. In addition, each terminal has 1,200 feet of dedicated boom which can be deployed in the water in 15 minutes, along with skimmers, personal protective gear and other marine spill response equipment.

Each tug carries between 150 and 300 feet of compactable boom on deck for immediate deployment. The new double-hull barges carry an additional 1,200 ft of river boom in an environmental container on deck supplemented by a pump, skimmer kit, and a motorized response skiff.

Tidewater owns 20,000 feet of oil boom, all of which can be made available for deployment at any site along the river within 6 hours. Reciprocal agreements are in place with the Clean River Cooperative to secure a further 20,000 feet of boom within 12 hours if necessary.

Two dedicated containment barges, each with 5,000 barrels storage capacity are maintained and certificated for use in spill emergencies to store product recovered after a spill. Product recovery is always a primary goal if feasible.

Regular spill response training ensures that all crews are fully competent to respond to a spill event. Employees participate in frequent continuing education and practice sessions on the river to maintain a high level of response proficiency. A typical course includes two days in the classroom followed by a full day on the river working with the response equipment under a variety of conditions.

The entire Tidewater operating philosophy is based on achieving zero spills. This philosophy is applied to every level of the organization, and is practiced by everyone from management to operations.

Q. Can you describe in more detail how you calculated spill frequency (number of spills) over time.

A. Yes. Spill frequency is estimated by first tabulating the number of oil spills over 2,100 gallons which occurred from tanker barges in U.S. domestic trade between 1992 and 1996 using records developed by the U.S. Coast Guard for the American Waterways Operators. The number of spills in each year is then divided by the total volume of all petroleum products (including crude oil) moved by U.S. domestic barge traffic (tabulated annually by the U.S. Army) to arrive at the number of spills per ton moved in each of the five years. These rates are then averaged to arrive at an overall baseline rate of 0.041 spills over 2,100 gallons per million tons transported. This represents current operations with primarily single-hull tank barges built prior to the new construction rules for double hulls (none of the new double hull barges built in the U.S. after OPA 90 contributed to the spills examined in this part of the analysis).

This baseline spill rate is then modified to better reflect the expected spill rate from double hull barges by using the relative probabilities of zero outflow from single and double hull tank barges of different sizes. This information is taken from graphs in the 1998 National Research Council study for the U.S. Coast Guard report to Congress on the impact of OPA 90. The influence of double hulls in reducing spill frequency is only applied in accidents involving grounding, collision or structural failure. The relative proportion of these types of accidents (85.7% of all incidents with a known cause) is contained in the Coast Guard spill database of barge spills over 1,000 gallons. As a result of this analysis, the baseline single hull rate shown above (0.041) is divided by a factor of 3.46 to arrive at a predicted spill rate of 0.0118 spills over 2,100 gallons per million tons transported in double hull barges. This reduction factor is considered very conservative when applied to Tidewater's operations, in that the new barges on the Columbia River have 50% more space between the outer hull and the cargo tanks, and between 30% and 44% thicker hull plating than required under the Coast Guard's OPA 90 regulations. The higher single hull spill rate is applied to double hulls involved in other types of accidents (e.g. transfer spills).

A similar process is applied to derive a separate spill rate for incidents between 21 and 2,100 gallons. In this case, there is no published data or validated statistics which can be used directly to calculate the number of these smaller spills. Instead, a number of sources have to be combined to generate a trend of spill frequency with a spill size. The 1998 National Research Council report shows the number of barge and tanker spills in U.S. waters over 100 gallons for the years 1991 to 1995. The same database used to calculate the spill rate for volumes over 2,100 gallons also contains incidents down to 1,000 gallons. The American Petroleum Institute (1998) publishes a record of spills down to 10 gallons and smaller from all vessels from 1987 to 1996. By combining these sources, it is possible to establish trend lines for different vessel types showing the rate of increase in spill frequency with reducing spill size. These trends are used here to estimate the number of barge spills in the 21 to 2100 gallon size range for the period 1992 to 1996. For example, results show that, over time, the number of barge spills over 21 gallons will be seven times greater on average than the number of spills over 2,100 gallons. These results are then used to calculate a national rate of 0.246 spills between 21 to 2100 gallons per million tons of product transported by single hull barges.

This derived baseline spill rate is then modified as before to reflect the benefits of double hull barges, by considering the proportion of incidents in the smaller spill size range which involve groundings, collisions or structural failure (estimated as only 16.6%). As the majority of very small spills tend to occur as a result of transfer incidents, the overall influence of double hulls in reducing the number of small spills is less pronounced than with spills over 2,100 gallons. The single hull rate for small spills is divided by a factor of only 1.16 to arrive at a predicted rate of 0.212 spills between 21 and 2100 gallons per million tons transported in double hull barges. Again, the higher single hull spill rate is applied to double hulls involved in other types of accidents (e.g. transfer spills).

The resulting single hull and double hull barge spill rates per ton of product moved are applied to the actual tonnage moved in each type of barge upriver from Portland in 1998. Tidewater's records for that year show that out of a total of 2.12 million tons of petroleum product moved upriver, 65.8% was transported in double hull barges.

Predicted spill frequencies are then calculated for the two spill sizes used in this analysis (21 to 2,100 gallons, and greater than 2,100 gallons) for each year through 2049 (50 years from 1999 as the baseline year).

I considered two cases. First, the existing (1998) tonnage moved in single hull barges remains constant while the additional product necessary to meet an overall 1.5% annual increase in demand is carried in double hull barges up to the year 2014. Beginning Jan 1, 2015 all product moving upriver is shifted to double hulls to comply with the U.S. Coast Guard mandated retirement age for single hull barges under 5,000 gross tons. The annual volumes carried in double hulls starting in 2015 continue to grow at the same 1.5% compounded annual rate through 2049.

In the second case, 1998 volumes are held constant with no growth in demand. The existing proportion of single hull and double hull tonnage is maintained again until the end of 2014 at which time all of the product is shifted to double hulls.

Q. Can you describe in more detail how you calculated spill volume over time?

A. Yes. Average spill volumes are calculated for the same two spill size ranges used to analyze frequency (21 to 2,100 gallons and greater than 2,100 gallons). The primary information source of the larger spills is again the U.S. Coast Guard record over five years of all barge incidents over 2,100 gallons supplied by the American Waterways Operators. Results from this database show that when known coastal spills from ocean going barges are excluded, the average barge spill size for the remaining 50 incidents involving spills over 2,100 gallons (including transfers and navigation accidents) is 43,951 gallons. This volume represents the average volume of spills primarily from single hull barges involved in any type of accident (e.g., transfers, collisions, groundings etc.). It should be noted that Tidewater has only had one marine spill large enough to be considered in the over 2,100 gallon category used in this analysis (3,295 gallons on October 14, 1993).

The average volume spilled from double hull barges (involved in the same mix of accidents) is calculated as follows: a subset of 31 incidents is created which involve only structural failure, grounding or collision. The average spill volume of these incidents is 58,136 gallons. According to analysis presented by the National Research Council (1998), the average volume spilled from a double hulled barge will be 5.33 times less than a single hull barge in groundings and collisions. Consequently, the predicted average spill volume which would have resulted if double hull barges had been involved in the same 31 incidents is calculated as 58,136/5.33 = 10,907 gallons. The average volume for the remaining 19 incidents (out of the original 50) is 16,181 gallons reflecting the much smaller size of primarily transfer accidents. A weighted average of the spill volumes associated with each incident grouping results in an overall predicted spill size from double hull barges of 12,911 gallons for all spills over 2,100 gallons.

For smaller spills a representative volume is derived from the distribution of all marine spills published by the American Petroleum Institute. This national estimate of 173 gallons is not specific to any vessel type, but compares closely with Tidewater's own record of small spills (21 to 2,100 gallons). Tidewater’s small spills from 1986-98 averaged 121 gallons. No distinction is made between single and double hull barges in calculating average volumes for the smaller spills, reflecting the relatively small number of grounding and collision type accidents which spill less than 2,100 gallons.

Predictions are made regarding the annual and cumulative volumes of petroleum spilled from a barge system operating on the Columbia/Snake Rivers is made by multiplying the spill frequencies discussed above by the corresponding average spill volumes outlined here for each spill size range.

Q. Please explain why the projected barge spill risk (No Action) in the Application is incorrect.

A. The projected barge spill risk in the Application is wrong for many reasons. Primarily, fundamental differences between the transportation of petroleum via pipeline and via river barge are either poorly accounted for in the risk analysis in the Application (and the DEIS), or are completely ignored.

<u>Risk vs. time is misrepresented</u>. Pipelines become substantially riskier with age (Mastandrea, 1982 & 1999), while barges operating in freshwater river environments do

not (Hatfield, pers. comm.). Barges are subject to mandatory haul-outs and hull inspections by the United States Coast Guard. Barges can be replaced by new vessels as required over time. There is no equivalent process of direct inspection or replacement of pipelines (short of excavating the line).

Double-hull benefits are not considered. Transportation of petroleum in double-hull barges results in a large reduction in not only the number of petroleum spills but also the volume associated with any given spill (National Research Council, 1998). The Application makes no adjustment in the spill risk for the double hull barges.

Relative spill volumes are not considered. Spill risk involves both the frequency and the volume of events. The Application does not consider these factors in any consistent manner. A meaningful comparison between the risk of different transport modes is impossible to make based on the information presented in either the Application or the DEIS.

Opportunities for rapid detection of spills are not compared. Pipelines have an inherent risk of leaks running undetected for long periods of time. Barge spills less than one gallon are immediately detectable. The Application makes no adjustment in spill volume based on this certainty of immediate detection in a marine environment. For example, a single gallon of petroleum can produce a very visible silvery sheen on the water covering 400,000 square feet.

Q. Please describe the quality of information used in the Application, and information missing in the Application's risk analysis.

A. Both the Application and the DEIS fail to use the best available information to predict barge spill rates and spill sizes. A number of different databases must be combined to accurately predict barge spill rates and spill sizes which reflect current operating practices. Examples of sources include the U.S. Coast Guard statistics publicly available (1992-96), data from the American Petroleum Institute (1998), and the U.S. Army Corps of Engineers Waterborne Commerce (annual), and published reports of the National Research Council (1998).

Neither the Application nor the DEIS use any current sources representative of marine operations subsequent to the implementation of the Oil Pollution Act of 1990 (OPA 90). All of these sources point to a dramatic drop in both the numbers and volume of petroleum spills from vessels beginning in the early 1990's. For example, when comparing 1987-91 with 1992-96, API data (98) shows a 47% reduction in the total number of vessel spills, and an 81% reduction in the volume of vessel spills in U.S. waters.

The Application on the other hand, uses a narrowly focused database of 40 incidents between 1974 and 1989, all exceeding 42,000 gallons, to predict barge spills of any size (Cohen and Aylesworth, 1990). The DEIS predicts barge spill rates based on two values: one for large spills based on rates derived from an outdated set of 1974-1980 worldwide tanker statistics, which only considered spills over 42,000 gallons, and which represent a completely different type of vessel (Lanfear and Amstutz, 1983); and a different rate for small spills, the source of which its author cannot locate (Chambers, pers. comm.). The use of these incorrect statistics caused the analysis to be greatly skewed in both documents.

The Application ignores the substantial benefits demonstrated for double hull tanker barges involved in collisions and groundings (fewer and smaller spills). The National Research Council (1998) conducted an exhaustive evaluation of the effectiveness of different double hulls designs in a variety of grounding and collision scenarios. This report was subjected to extensive peer review and incorporated input from a broad cross section of vessel operators, shipyards and vessel designers, classification societies and naval architects worldwide. The NRC findings were used to support the U.S. Coast Guard's report to Congress on the impact of OPA 90. NRC (98) provides engineering estimates that double hull tank barges of 10,000 deadweight tons (similar in size to those vessels currently in service on the Columbia/Snake River system) will have a seven times higher probability of experiencing zero petroleum outflow in groundings or collisions when compared with a single hull barge. At the same time, where spills do occur from double hull barges in such incidents, the average volume is estimated in the same study to be over five times smaller.

The risk reduction benefits of double hulls are currently enjoyed by a large proportion of Tidewater’s fleet. Tidewater carried 65.8% of all petroleum products upriver in double hull barges in 1998. Further, Tidewater’s four double-hull barges far exceed the design standards required by OPA 90 in hull strength and the protective space separating the cargo tanks and the outer hull. These barges were first introduced in 1994, over twenty years in advance of when required by law. The Application incorrectly assumes that additional "standard" or single hull barges will be added to the system after 2014 to meet increased demand. Under OPA 90, no single hull petroleum barges can be operated in U.S. waters after December 31, 2014.

Q. Please explain the estimated product loss from a break in a pipeline or a rupture in a barge hull.

A. Misleading comparisons are made in the Application between what is considered a reasonable amount of oil to drain out in the event of break in the pipeline and a barge hull. The DEIS (Sec. 3.18.3) explains that the average amount calculated to drain out in the 12 pipeline spill scenarios is 21.5% of the pipe contents. In contrast, the river barge scenario described in the Application involves the loss of 15,000 barrels, representing 60% of the contents of one of the existing single hull barges.

Findings in NRC (98) indicate that a reasonable volume estimate for petroleum release from a barge in a grounding or collision would range from less than 1% of the contents of double hull vessel to approximately 5% for a single hull; but certainly nothing close to the loss figure set forth in the Application.

As noted above, I have constructed two spill scenarios that represent an accurate estimation of "expected worst case" accidents involving the marine transportation of petroleum. See Exhibits DFD-7 and DFD-8. The Application's approach to spill scenarios is not credible scientifically, and artificially skews the analysis.

Q. Have you figured out what specific mistakes the Application makes in development of the barge risk analysis in the Application?

A. Yes. In order to understand the problems with the barge risk analysis conducted in the Application it is necessary to provide some background as to how the spill rates were derived by the original researchers quoted from 1990 (Cohen and Aylesworth). This source describes how a spill rate based on tonnage moved is converted into two separate rates: one rate per distance traveled and another rate for spills per port call. In order to achieve this conversion, a great many assumptions had to be made as to the number of trips and port calls made by barges both in the U.S. and the Pacific Northwest. I determined from discussions with a number of other experts in the field that there is no reliable source of such data on a national level (W. Miller, Cdr. C. Boegel (U.S.C.G.)). The resulting calculation for the number of spills per nautical mile quoted in Cohen and

Aylesworth is many times higher than it should be. For example, the California State Lands Commission (1994) used a Coast Guard value for San Francisco bay of 0.8 spills over 100 gallons per million nautical miles for barges; Cohen estimated a rate of 1.3 spills over 42,000 gallons per million miles. The average number of spills over 100 gallons is more than an order of magnitude higher than the number over 42,000 gallons. The primary spill rate for barges in transit (underway) developed by Cohen and Aylesworth and used by OPL in their barge risk analysis is incorrect and cannot be supported by any other research.

The spill rate values used as the basis for barge spill risk in the Application are seriously deficient in three main areas: they do not accept that double hulls will effect future spill rates; they ignore the fact that the original source use clearly stated that the rates applied only to spills over 1,000 barrels (42,000 gallons); and they do not reflect the significant reduction in spill risk which followed the introduction of OPA 90.

Q. How do the spill histories of Tidewater and Olympic compare with each other and with your predictions of future spill risk?

A. Olympic's spill history is much worse. In over 50 years of operation, Tidewater has had only one significant marine spill on the Columbia system (3,295 gallons on October 14, 1993). The second largest marine spill was 370 gallons. Over the twelve year period from 1986 to 1997 the total volume of all spills reported for the barge system (down to less than 1 gallon) was 4,317 gallons (company records). Over the same period the existing OPL system spilled in excess of 320,250 gallons in 16 incidents, one of which involved 168,000 gallons. (DEIS, pg. A-15)

The overall trend in these numbers is very consistent with the statistics and predictions presented above. These numbers reflect a much greater risk of spills from pipelines that from river barges.

END OF DIRECT TESTIMONY

Dated this 12th day of February, 1999.

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David F. Dickins